THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

THE TANJORE MAHARAJA SERFOGI'S SARASWATI MAHAL.

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Consisting of

ORIGINAL COMMUNICATIONS,

SPECIFICATIONS OF PATENT INVENTIONS,

PRACTICAL AND INTERESTING PAPERS,

SELECTED FROM

THE PHILOSOPHICAL TRANSACTIONS AND

SCIENTIFIC JOURNALS OF ALL NATIONS.

MONTHLY INTELLIGENCE

RELATING TO

THE USEFUL ARTS,

PROCEEDINGS OF LEARNED SOCIETIES,

AND

NOTICES OF ALL PATENTS GRANTED FOR INVENTIONS.

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AND

AGRICULTURE.

NUMBER XXV. SECOND SERIES. June 1, 1804.

Specification of the Patent granted to GEORGE PENTON, *of New-street-square, in the City of London, Brass-founder; for an Improvement on Lamps, commonly called Argand's Lamp.* Dated November 19, 1803.

With a Plate.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said George Penton do hereby declare that my said invention of an improvement in lamps, commonly called Argand's lamps, consists in a new method of raising and lowering the cotton wick, an operation which is usually performed by a rack and pinion, or wire, and is attended with this inconvenience, that as the cotton burns away, the rack or wire employed to raise the wick remains above the flame. The means I have invented to remove this defect are by applying a chain and pulley, variously contrived, instead of the wire, or rack and pinion.

The references to the drawing will shew a method of effecting this object.

Fig. 1, A B C D, (Plate I.) is a cylindric tube, containing the ring to which the cotton-wick is fastened, and has a slit on one side, to suffer the wick-holder to move up and down by means of the chains *a a*. One end of each chain is soldered, or otherwise fastened, to the ring of the wick-holder at *c*, and the other ends in the groove of the pulley P, in such situation on it as when moved round will raise or lower the wick the full length required. *m* is an arm of metal, on which the pulley P is fixed: it is fastened at *b*, and projected from the cylinder so as to admit of the pulley and chain behind it to work freely.

On the axis of the pulley a button is fixed, by turning of which the chains *a a* move over two pivots or rollers *d d*, fixed near the top of the tube, and on a pivot or roller E projecting from a ring fixed on the inside of the tube A B C D, at the bottom. By this means the wick is raised or lowered at pleasure, by turning the button with the thumb and finger.

Fig. 2, view of the burner when complete.

Fig. 3, section of the same.

The same effect may be produced by means of a single chain, the weight of the cotton-holder to carry itself down. It may be proper to observe that catgut, thread, or any other flexible material, may be used instead of the chain.

In witness whereof, &c.

Specification

Specification of the Patent granted to JAMES THOMSON, *of Edinburgh, Bell-hanger; for certain new Improvements in hanging Bells, Window Curtains, Window and other Blinds, and other Things.* Dated June 14, 1803.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said James Thomson do hereby declare that my invention is on an entire new principle, by substituting a balance or lever, to answer instead of springs.

The drawings of the apparatus I describe as follows, *viz.*

Fig. 1 (Pl. II.) a bell and carriage without any spring. A, a pivot driven into the wall, which the carriage moves upon. B, carriage, nine inches long. C, a balance to answer the purpose of a spring; this may be any shape, and screwed to the neck of the carriage: these may be of different weights, one for one room, and a heavier for two rooms, and so on, the bell-hanger changing the balances till they do the business to a nicety. D, a screwed eye, four inches long, to fix the wire to, and to screw out or in till the wire be perfectly straight with the hole or crank it is next in contact with, or screwed out altogether, and the wire fixed in the hole.

Fig. 2, a bell and carriage, the same as Fig. 1, with this difference, that A is made to move up or down, so as to make the wire straight as in Fig. 1.

Fig. 3, a crank on a screwed plate. A, the crank. B, the screwed plate. C, a stop from the crank to the plate, which checks the crank to its proper position, and prevents it from being pulled too far. D, a screw, on

which may be fixed an ornamental piece of brass, to hide the crank if required. E, a balance screwed into the crank, to answer instead of a check spring; these being of different weights, you can choose one nearly the weight of the handle or pull, fixed to the crank, so as just to check it, so that every pull-crank supports itself, and the bell has only to take back the wire and corner cranks that may intervene between the pull-crank and bell.

Fig. 4, a crank the same as Fig. 3, only it is driven into the wall by a pike. A, a pike.

Fig. 5, a mortise crank, that goes into the wall. A, a balance the same as Fig. 3.

Fig. 6, a lever that screws upon the wall, and pulls down by the handle A. A, handle that is balanced to stand always as represented in the drawing.

Fig. 7, a lever for fixing on the surbase, and to pull from below, and balancing itself the same as Fig. 6.

Fig. 8, a crank with one arm and slip-pull, that gives the slip before the arm is pulled to the check; the bell going back with a sudden jirk makes it give a full and uniform ring at all times, so that a child pulling down to the check must ring it as well as the bell-hanger. A, the crank arm. B, slip-pull with a jointed head. C, jointed head, that after pulling gives way to the crank arm, and falls to its present position by means of a balance. D, a balance, which must be heavy enough to take back all the wire and cranks connected with this bell, the bell only needing a balance heavy enough to make a full ring. E, wire to next crank. F, wire to the bell, and about eighteen inches long.

Fig. 9, a bell and carriage to strike but once. A, pike rivetted into the carriage, and driven into the wall. B, carriage, six inches long. C, crank arm, turning on a pin,

pin, with a screwed nut, so that you may turn it to either side the carriage. D, hammer to strike the bell with, screwed or rivetted into the crank arm. E, a pin to check the hammer from lying upon the bell. F, bell the same as a clock bell.

Fig. 10 *, a crank with one arm, and slip-pull the same as Fig. 8, and must connect with Fig. 9.

Fig. 11, a roller blind to work by a balance. A, a curtain or blind rolled round a white iron barrel. B, a brass or white iron pulley. C, a piece of tape, painted to keep it straight when rolling round the pulley. D, a piece of brass or iron rod, with a swivel fixed to the tape, to answer as a balance to the weight of the cloth to make it stand at any height wanted. This may come down by the battin, or carried behind the window-shutter, so as not to be seen when the window-shutter is put back, taking care to put it up or down by the rod without touching the tape.

A balance may in the same manner be applied to Venetian blinds, window-curtains, map-rollers, &c. &c. &c.

In witness whereof, &c.

Observations by the Patentee.

During thirty years constant practice, I have endeavoured to improve the art of bell-hanging to the utmost of my power. I was never pleased with the common mode of making the machinery perform by virtue of a spring or springs; the power of which being so un-

* This figure does not appear in the drawings attached to the record.

certain

certain as to the strength to be applied to every situation or weight of work to be done; their liability to break, and losing their power after being some time in use, urged me to contrive something more simple and less liable to go wrong. After considerable study and expense I think I have attained the end (as far as possible, on a new principle, which will be the means of introducing that fine or easy motion in the bell-hanging art so much wanted) by substituting a balance or lever instead of springs, the powers of which are described in the specification of the drawings of the apparatus; by which it will appear that the bell-hanger has it in his power, to a very great nicety, to give just the proper power to whatever work may be required to be done, and that power not liable to go wrong, or fail.

The simplicity of the principle, when properly executed, cannot fail to make the work perform with the greatest possible ease. I think it proper to mention that the drawings in the specification were taken from the bells which were first set in motion, merely to show to the trade the principle and power of the balance. I am aware that the apparatus will be found in practice capable of improvement; for instance, in Fig. 3, E is a balance, screwed into the crank, to answer instead of a check spring; this may be made the ornamental piece of brass to hide the crank, as mentioned in D, and answer both purposes.

In Fig. 8, should it be desired to have more pulls than one upon the same bell, one slip-crank, fixed about twenty inches from the bell, will answer the whole, and produce a strong uniform ring every time it is rung; but this slip-crank may be either adopted or not, at the pleasure of the gentleman or of the bell-hanger.

In

In Fig. 1, C is a balance, to answer the purpose of a spring, which must be so heavy as to make the bell give a hearty ring; when the bell is wanted to ring or toll for some length of time, a vibrating spring may be fixed to this bell; or there may be a ball to toll on the side of the bell for any length of time to $1\frac{1}{2}$ minute.

Fig. 9 may answer many useful purposes, but must be connected with Fig. 8, in order to give a strong full ring. It may also answer as a telegraph, to call any particular servant or thing, according to the number of rings; or be adapted, with good effect, to vary the sound of the bells, where a great number are to hang in one place.

Specification of the Patent granted to RICHARD YOUNGER, *of Pittman's-buildings, Old-street, in the County of Middlesex, Gentleman; for a Method of extracting Worts from Malt, Barley, and other Grains and Substances.* Dated November 12, 1803.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Richard Younger do hereby declare that my said invention consists in this, that the vessel in which the ingredients are put, from which the worts are to be extracted, is to be guarded from the immediate action of the fire by which it is to be heated; and the proper degree of heat is to be communicated to it by boiling water, or any other liquid which will receive and communicate the same degree of heat as water against the bottom, sides, or other parts of the vessel in which the ingredients are put. I believe water is the most proper liquid to be used. The construction of the apparatus

tus admits of great variety and latitude, but the following apparatus and mode of operating will produce the worts in the manner I propose. Let the cauldron or boiler in which the malt, barley, or other grains or substances are to be put, and from which the worts are to be extracted, be immersed in another boiler containing water, and heated by a fire or furnace in any of the ways in which boilers are or may be heated. The fire therefore is not applied immediately to the boiler containing the ingredients from which the worts are to be extracted but to the external or outer boiler, and the water contained therein. This apparatus is not described or claimed as my invention. The inner boiler is to be fixed at a convenient distance from the bottom and sides of the outer one, and the two should be joined together at or near their tops. If the inner boiler is made for two quarters of malt, the distance of six inches from the bottom and sides of the outer one is a convenient distance to draw off the wort. A cock may be made to pass from the inner boiler quite through the outer one. The inner boiler may be open at top, or closed; but it is better to be closed, except in the apertures for regulating the escape of the steam. In the inner one, which in my method of operation serves as a mash-tun, a false bottom is advantageous, though not absolutely necessary; and agitaters or stirrers are also advantageous, which may be worked either by machinery or by hand. After the malt or other grains and substances from which worts are to be extracted are ground or bruised, they are to be introduced into the inner vessel above mentioned, and a proper quantity of cold water added: from seven to eight barrels of water is a proper quantity for four quarters of malt. This being done, and the outer boiler filled with

water

Fig. 1.

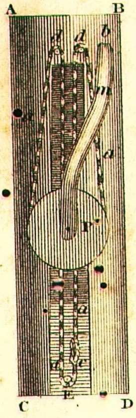


Fig. 2.

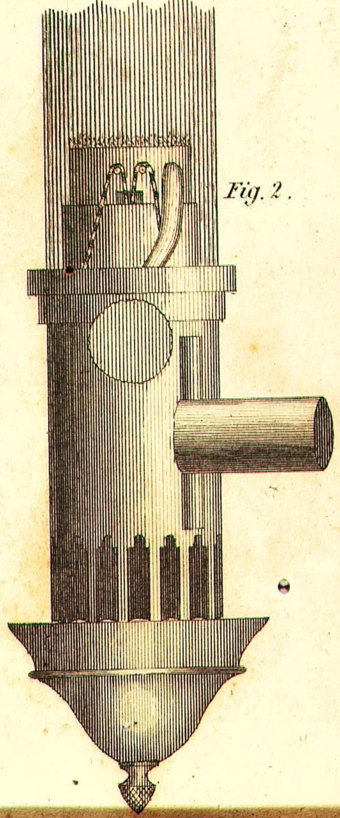
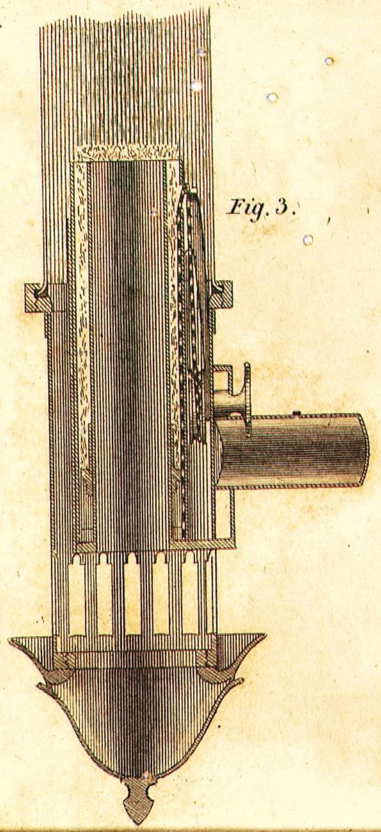


Fig. 3.



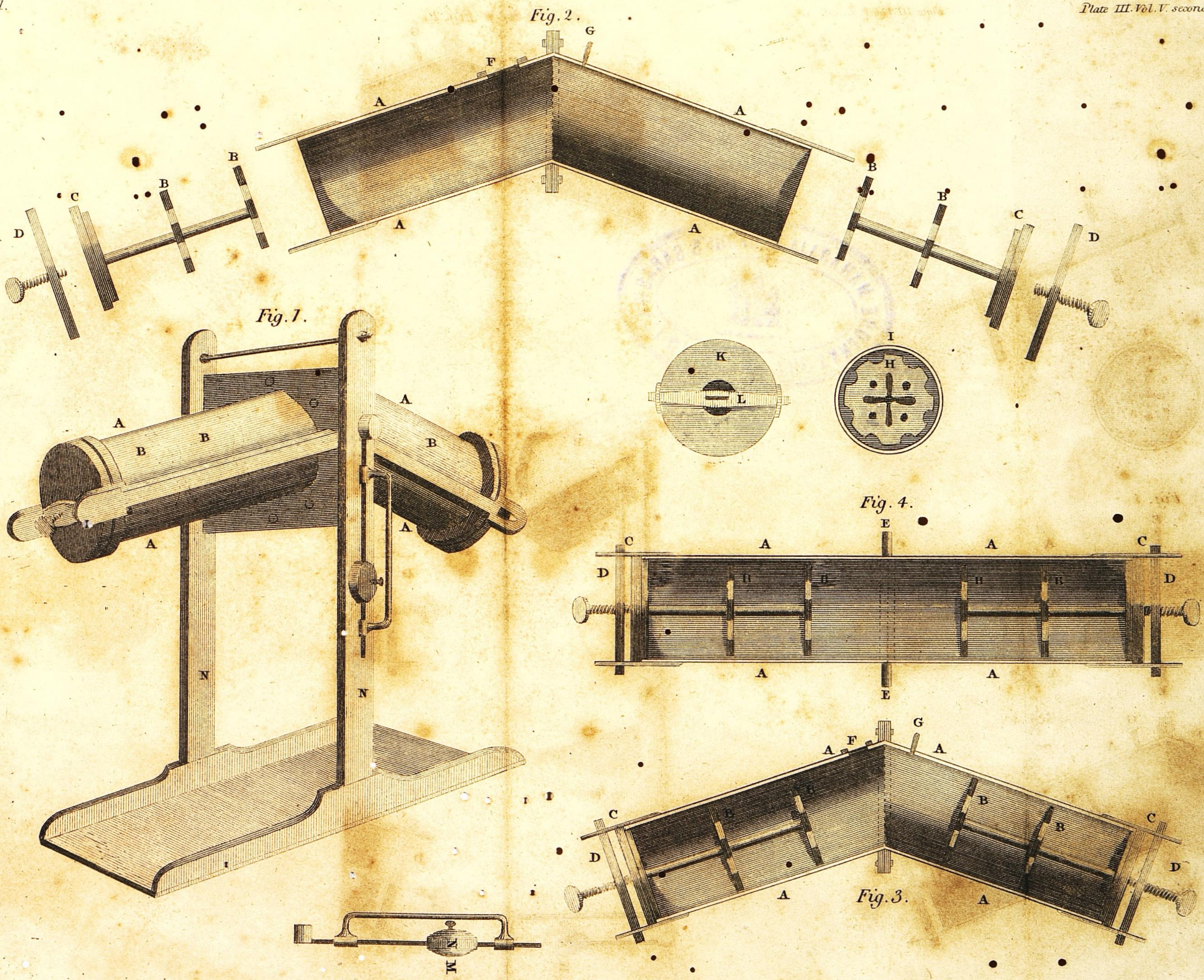


Fig. 2.
Fig. 1.
Fig. 4.
Fig. 3.
A
B
C
D
E
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water, fire may be instantly applied to the outer boiler. But I find that a stronger and better extract is made if, before applying the fire, the ingredients be left to macerate for some time; twelve hours is a proper time for malt, and one or two hours more may be allowed for raw barley, or for a mixture of malt and barley. After the materials have thus been suffered to macerate for a sufficient length of time, a fire is to be placed under the outer boiler, which, acting upon the water contained betwixt it and the inner one, will in due time communicate such a degree of heat to the latter as may be requisite. I recommend the highest heat the water in the outer boiler can admit of, to be continued till the worts are extracted. The contents of the inner boiler should occasionally be stirred, especially if the quantity of the materials be great. After the first extract is made and drawn off, hot water may be repeatedly used on the remaining matter, for the purpose of making up the length, as it is termed, or the quantity of worts; but the water should not be quite boiling, and cold water should not be used on any account. By this method of proceeding, the heat being gradually applied and carried to the degree necessary for such a process, the saccharine and other soluble matter is more effectually extracted from the malt, &c. the extract is obtained free from acidity, and the beer consequently so sound and untainted as to run less risk of spoiling than that made from worts prepared in the usual manner. The worts may be extracted in the same way for the malt distillery, and for making vinegar.

In witness whereof, &c.

Observations by the Patentee.

The advantages resulting from this mode of mashing must be obvious to every brewer. The pores of the grain are so completely opened by the long continued maceration in cold water, that on a quick application of heat, in an apparatus perfectly constructed, every particle of saccharine matter may be extracted, and nothing left but mere husks, whether the malt is of a good or bad quality. It has also a similar effect on barley, or other raw grain, so that the malt-distiller will be equally benefitted with the brewer. At first sight it may appear that the quantity of coals employed in this process is greater than is consumed in the common way; that, however, is not the fact, the boiling steam issuing from the exterior copper being capable of heating a body of water sufficient for a second and third mash.

It is a well-known fact, that malt newly taken from the kiln will not yield the same quantity and quality of worts as that which has been for some time exposed to the atmosphere of a granery; the reason of which is, that the former possesses no moisture, which acts as a conductor for the hot liquor, but the latter, being mellowed by time, and having imbibed the moisture of the atmosphere, opposes less resistance to the introduction of the water into the particles of which the mash is composed.

This being the case, how much more perfect will the extract be made when a body of cold water has been applied to the mash previous to the application of so great a heat as 200 degrees, which may be communicated to the mash; this is also a saving of fuel, as the worts run into the copper only 12 degrees below the boiling point.

The

The extract is so strong in the first mash in particular, that a second mash completely exhausts the strength of the grains, by which the expense of a third mash is saved.

It has been proved, by comparative experiments made on the same malt, that the extract of worts produced by this mode of mashing exceeds that obtained by the usual process by at least 20 *per cent.*

Specification of the Patent granted to THOMAS ROWNTREE, *of Great Surrey Road, in the Parish of Christ Church, in the County of Surrey, Engine-maker; for a Machine, on an improved Construction, for agitating and separating certain Mixtures.* Dated March 23, 1804.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Thomas Rowntree do describe my improved machine for agitating and separating certain mixtures, or compound fluids, in manner following. It is well known that milk is a mixture or compound of oil, lymph, serum, and salt, the separation of which produces butter, cheese, and whey. The serous and oleaginous parts separate after standing some time, and rise to the top in the form of cream. From this cream, put into a churn, butter is produced, by the agitation and separation of its parts. The machine, which I have invented for this purpose, and which I call my agitating and separating machine for making butter, and for other purposes where agitation or separation is required, is represented in the annexed drawings. It consits of a tube, or tubes, either

 bent

bent or straight, for the reception of the cream, but open at both ends, and in which are inserted breakers, with two caps, at their outer extremities, made in such a manner as to fit closely to each end of the tube; or these caps may be loose, and fitted on or taken off at pleasure, as occasion may require.

Fig. 1 (Plate III.) represents an outside view of the machine, as fixed to its frame N N, and hanging on its axes or centres.

Fig. 2 represents a section of the machine, in which A A A A is an open bent tube, with the breakers B B B B out of the tube. C C are the two caps connected with the breakers, and which are so contrived as to fit closely to the two ends of the tube. D D are two cross-bars, placed on the outside of the caps, and made to press against them by screws, or wedges, or in any other manner, so as to prevent the cream from running out during the time of working or agitating the machine.

Fig. 3 is a section of the machine, with the breakers B B B B withinside. C C are the two caps. D D are the cross-bars, with their screws, as fixed for work.

Fig. 4 represents a section of a straight tube, with the same apparatus as before described in Fig. 3, and shewing its axes or centres E E, on which the machine is suspended, and moved backwards and forwards. F is a small opening in the upper part of the tube, Figs. 2 and 3, wherein to pour the cream; or, if it be thought preferable, the cream may be poured in at one end of the tube while the other is closed. G is a vent-peg. H is an end-view of one of the breakers. I is an end-view of the tube or cylinder containing the breakers. K is an end-view of one of the caps, and L is a front-view of the cross-bar, with its screw pressing against the cap. M is the handle, lever, or pendulum, for giving motion to the machine,

machine, such as is usual in other machinery; to which is affixed a moveable sliding weight, for the purpose of adjusting or balancing the weight of cream in the tube, so as to produce an equilibrium in the machine, whether the quantity of cream be small or great.

The advantages peculiar to this new machine for churning or making butter will appear more striking by a comparison with the disadvantages inseparable from those heretofore made use of, whether they be barrel-churns or upright churns. It has long been a complaint against barrel-churns, that from the very nature of their construction they are incapable of producing butter which will be perfectly sweet; for having only one small opening in them, just sufficient to permit the hand and arm to enter them, it is impossible for the fresh air to penetrate to their bottom and sides, much less to sweeten them by a free circulation or current. Hence arises that sour and rancid smell which is always perceived in the barrel-churn, even after it has been scalded and scowered, and cleaned with the greatest care, and which adheres to the inside of the vessel in the same manner as foul air does in a well that has been long closed. The upright churn is liable to the same objection, and retains the same rancid smell after use, though in a small degree; for even in this churn a free circulation of air cannot by any means be obtained, but the foul air constantly remains attached to the bottom and sides, and renders the churn unfit for the production of sweet butter. This complaint, however, is completely remedied in my improved machine for making butter; for as the part which contains the cream consists of a tube or cylinder, as before described, open at both ends, and having a cap to each, which is fitted on and taken off at pleasure, it is evident that the whole of the inside, as well as the breakers and the

the caps at each end, may be as easily cleaned, and as perfectly sweetened by exposure to a current or circulation of fresh air, as any utensil belonging to the dairy.

Another disadvantage peculiar to the barrel-churn consists in this, that a considerable part of the cream which is intended to be converted into butter rolls smoothly along the bottom of the churn, when put into a rotary motion, without ever being obstructed by the breakers, and consequently without any chance of producing the desired effect; for in order to procure the greatest possible quantity of butter from a given quantity of cream, it is absolutely necessary that every portion of the cream be violently agitated and dashed against the breakers. It is plain, therefore, that in the common barrel-churn a less quantity of butter is procured than the cream is capable of yielding; and although the loss sustained each time of churning may be thought little of, yet in large dairies it will be found very considerable in the course of a year. The same disadvantage belongs to the upright churn; for in that also the cream suffers only a partial agitation, by no means sufficient to produce the quantity of butter which might be expected. This imperfection, which all machines heretofore used for the purpose of making butter are alike subject to, finds no place in my new and improved churn; but the whole body of the cream is dashed with violence against the breakers, in every motion of the machine backwards and forwards, so that not the smallest portion of the fluid is suffered to glide along in an equable or uniform course, but each part is alike broken and driven in all possible directions. The consequence of which is, that more butter is procured with my churn, from a given quantity of cream, than with any other heretofore made public.

Besides

Besides the above advantages, which are peculiar to my improved machine for making butter, the ease with which it may be worked is an additional recommendation to it, more especially as it requires in the person using it neither judgment nor experience in the art of making butter, but may safely be entrusted to the management of a child. I therefore submit it to the public as a necessary and most valuable utensil in the dairy; not doubting but it will be found, on trial, an improvement of real utility, and well calculated not only to make butter in the greatest quantity, but what is of much more importance, to produce it in its utmost purity and sweetness.

In witness whereof, &c.

Experiments on preparing Potatoes in Digesters for feeding Lean and fattening other Stock.

By the Rev. William Pierrepont, *of Burton Park, near Petworth, Sussex.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

THE object of the Society for the Encouragement of Arts, &c. being the general benefit of the community, the following method of preparing potatoes, for the purpose of both feeding lean and fattening other stock will, I conceive and hope, from the experiments I have already made, contribute something to the end which the Society has in view. Not altogether satisfied with the system of curing or preparing potatoes by steam from heated water, which I had practised, and conceiving that some better method might be found out, I made

I made several experiments in the year 1801, and bestowed great attention and pains before I brought the following plan to bear.

I have half a dozen common six-gallon iron digesters, which are filled with potatoes, either fresh washed from the water or dry; for I cannot find that their being in a wet or dry state makes any difference. They are then put into an oven, the bottom of which is a *cast-iron* plate, three feet ten inches long by two feet ten inches wide; under which is the fire divided into three parts. Of this, the middle part, or division, is eighteen inches: the two other divisions are ten inches each: the remaining eight inches rest upon the brick-work. The heat is conducted half one way, and half the other, round the sides of the oven to the mouth, which is nearly eighteen inches square, and then over the top, uniting in the chimney, in which is placed a damper. There is also an iron rod, with a segment of a circle at one end, for the purpose of pushing the digesters into the oven from the mouth, and a hook at the other end, to draw them back to the mouth when done. The first round, that is, the six digesters first put into the oven, take about two hours in baking, supposing the fire not kindled before they are put in; and every round after the first may be done in little more than hour. This process requires very little fuel, and by no means the attention or the force necessary for steaming; as the potatoes will be done quicker or slower in proportion to the heat applied, without any of it being lost for want of greater force; even one round left in the oven over night, with a mere trifle of fuel, will be done the next morning: but I do not allow that to be done, because it turns the potatoes black, and hurts the digesters. Observe, the digesters must occasionally be rubbed on the inside with a little lard

lard or dripping. Potatoes cured this way are not by any means so apt to turn sour, or scour the cattle, and are more dry; so that the animal fed with them drinks much more, and they become harder when cold, so as to be flung to the stock with more convenience than when steamed.

In the year 1802 I fattened fifteen brace of bucks chiefly with them; I say chiefly, for, after the potatoes were gone, they had a few beans. They were very fine, and peculiarly well flavoured. Biggs, at Temple-Bar, had thirteen brace of them. I also fattened, the same year, with them, two oxen, three cows, and two pigs, which were equally well flavoured, particularly the fat; the pigs had, towards the latter end, a few whole peas after each meal; the bucks had six pounds *per* day each, at an average; the lean deer in the park do very well with little more than a pound *per* day instead of hay. This year, that is, within the last seven or eight months, I have fattened two very large oxen and twenty Welch wethers; the wethers, with which there were two South-Down rams and one ewe, had eigthty pounds of the potatoes *per* day, with a little cut hay. The ewe was put with them to teach the other sheep to eat them: she has since had twin lambs; and the bailiff acknowledges that the lambs do better than the others at turnips, though he, with some other persons, dissuaded me from trying more ewes, under the idea that the potatoes would dry up their milk. Four dairy-cows never did so well with very good hay as they did last winter with about four pounds of the potatoes, and about five pounds of rubbishy hay and straw cut. But enough on this head.

The Earl of Egremont had two of the Welch wethers, and a sirloin of beef from one of the oxen. The other, for sale, on the 22d of March, weighed 343 stone; he

 has

has had about forty pounds thrice a day. I take the liberty of referring to Lord Egremont for the flavour of the meat. He has seen the process; and I shall request the honour of his Lordship's transmitting this to you, in case he thinks it deserving the Society's attention.

Note of the Earl of Egremont.

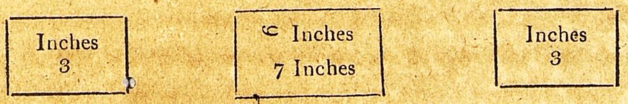
I know nothing of the expense of preparing potatoes in this manner; but I am inclined to think, that they are more nutritious than in any other mode of dressing. I did not think it possible to bring such large oxen to such a state of fatness upon potatoes. EGREMONT.

With all due acknowledgement to the Society of Arts, &c. for the honour they have done me, I could wish the following additions to be made to the preceding account. My reason for wishing it is, that any person willing to try the method in question may profit by the general result of the many and various experiments I made, without being at the expense and very great pains I was at, before I could bring it to bear in its present form. I had not the most distant idea of using digesters at the onset of the business; neither had I, nor have I, any interested motive in view, either for myself, or any other person, or indeed any motive than the benefit the public might derive from it. I have deemed it necessary and proper, both out of respect to the Earl of Egremont and myself, to make the above declaration and remark on this occasion. The following experiment was made, for the Earl of Egremont, to ascertain the quantity of fuel, &c. as *per* date.

At Burton Park, 21st of May, 1803, three bushels of potatoes were weighed separately (each bushel weighing

sixty

sixty pounds) before they were put into the six digesters. The potatoes from the two first digesters, taken out of the oven, when baked and weighed together, were fifty-five pounds; those from the two next were fifty-four pounds; and those from the third two, were fifty-four pounds. The carpenter measured the wood with which they were baked; and he tells me, that a cord, or stack of good fire-wood, well piled, (that is, wood cut into three-feet lengths, and piled twenty-four feet in length, and one foot ten inches in height, and which is sold in this neighbourhood for 12 *s.*) will bake ninety sets, or ninety times six digesters full of potatoes, at the rate of wood it took to bake the above six, which was the second set that day. A cast-iron plate, five feet in length, instead of three feet ten inches, by two feet ten inches, will hold eight digesters, and by adding a small fire, thus,



on each side of the great fire-place, will, in my opinion, accelerate the baking from fifteen to twenty minutes, in every set, as well as be some saving in fuel; because the side digesters generally take that time longer than the centre one. The merit of this process does not consist in slow simmering; for, the quicker the potatoes are done, provided proper attention is paid to them, the better. With the four following observations adhered to, any person may exercise his own judgment, and indulge his own information and fancy in erecting his oven, whether it be for a greater or smaller number of digesters, and according to the quantity of potatoes he may wish to bake.

D 2 1st.

1st. The digesters, or other vessels containing the potatoes, must not be in contact with the fire. 2d. The said vessels, even placed on cast-iron, must have legs, so that the bottoms of them do not touch the cast-iron. 3d. The lids must be steam-tight, in order to prevent its escaping before the potatoes are nearly done, with valves, if not the same, something similar to those of the digester. And, 4th, the external air is to be excluded from them; and the more effectually that is done the better; both for saving fuel and time, as well as to prevent their burning. I have never had occasion for more than six bakings in a day; which six bakings, that is, six sacks or eighteen bushels, at sixty pounds the bushel, were done within twelve hours. The father and his son had 12 *s. per* week for getting from the heap, washing and baking the potatoes, cleaving the wood for ditto, and feeding stock; 1080 lbs. of potatoes are baked for little more than six parts out of ninety of the cord, or stack of wood, above described. My opinion is, that two ovens, of six or eight digesters each, (according to the quantity of potatoes wanted,) would answer the best purpose; particularly where coals would be used, or the wood is ready cut; for then the same person could attend both, and one would be baking whilst the other was emptying and filling, and this whether for a great or small quantity. Perhaps two ovens erected together, with a single brick laid flat to divide them, with two fires at the end, so that each flue would go the whole length of the plate, mounting at the other end, and so over the top into the chimney, and the two doors of them at the two fronts would answer very well in point of economy, &c. Perhaps also an orifice just above the mouth of the oven, or in the door, with a moveable valve fixed to it, would prove useful, so that the steam which issues from the valves of the

digesters,

digesters, about ten or fifteen minutes before the potatoes are done, and which smells like that from roasted potatoes, might escape by it, instead of by the mouth of the oven. The above steam is attended by a hissing noise, and a kind of boiling commotion in the digesters, which the person attending them will very plainly hear on opening the door a little. When he perceives that noise, &c. begins to intermit, the digesters must be taken out, or the potatoes will burn at the bottom, and that in proportion to the degree of heat under them. A very little observation will soon make a person acquainted with the proper time of drawing them.

On the mucilaginous Matter of certain Vegetables, and their Use as a Substitute for Gum-arabic. By Mr. THOMAS WILLIS, *of Lime-street, London; being a Continuation of Experiments made upon the Subject by him, in Addition to those published in the Third Volume of the Second Series of this Work.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

FROM the candour and approbation my paper on the use of the Hyacinthus Non-scriptus, as a substitute for gum-arabic, in some trials in calico-printing, met with from the Society for the Encouragement of Arts, &c. I resolved to pursue the subject farther; and now offer the following observations for your consideration, in hope that trials may be made, that will be found to be of general benefit.

Having frequently observed, in old gardens, that the vernal squill grew very prolific, I conceived the root of them

them might be equally as mucilaginous as the roots of the blue-bells. I procured three pounds six ounces of them on the 8th July, 1802, and sliced and dried them. They produced one pound one ounce of powder, one drachm of which was dissolved in four ounces of water, by letting the mixture boil a minute or two. When the liquor was cold, there was a mucilage full as strong as one made with a drachm of the powder of blue bells, in the same proportion of water; from which circumstance, I should think the vernal squill will answer the same purposes as the hyacinthus non-scriptus. If it should, it is a root that may be very easily and plentifully propagated, and whenever gum-arabic is dear may be found useful. It is to be remarked, that I found no pungency in the powder of the vernal squill. I have frequently eaten of it, and the taste is rather agreeable.

On the 18th of August, 1802, I collected four pounds of the white lily root, which yielded, when dried, rather more than one pound of powder. A drachm of it was dissolved in four ounces of water, by gently boiling it a minute or two: the mucilage was much stronger than that made with the vernal squill, but somewhat darker coloured. This root may possibly answer the same purposes better than those above mentioned. The powder of the lily root leaves a bitterness on the tongue.

Twelve ounces of the fresh roots of the white lily being bruised and pressed, yielded by evaporation one ounce and one quarter of brown gum.

There being a small quantity of it, I made no trial with it; but very probably the expressed juice might be used by the calico-printers with advantage. These roots can be procured at all times, and propagated to any extent; but it must be observed, that these bulbous roots are stronger when they are without stems, or only beginning

ning to shoot out leaves; and the present time is as proper as any that can be for procuring them.

I tried comfrey root; but the dark colour of the cuticle of the root affected the solution, by making it of a dark dirty brown.

I do not pretend to claim any merit in making the above experiments. Every one who is acquainted with these roots well knows that they are all mucilaginous. My design is only, the patronage of the Society, to render them useful in the arts, that their virtues and effects might not lay dormant, but be rendered serviceable to trade.

After making the above trials, the powder of salop root was used, by dissolving one drachm of it in four ounces of water, in the manner above mentioned. It produced a very strong mucilage, and, when cold, was a perfect jelly, and much clearer than either of the other solutions. I am greatly of opinion, that the powder of this root will not only answer all the purposes of gum-arabic, but will be found full as cheap, if not cheaper, in proportion to its strength, than gum-arabic; but this is submitted to your consideration and trial.

I have sent some specimens of the Powder of the Vernal Squill, of White Lily Root, and also of the Salop Powder, in order that they may be tried by your direction; and if they should be found of benefit to commerce, nothing would give me greater pleasure than to find my slender abilities have been of utility to my country, and honoured with the approbation of the Society.

Report on the Means of disinfecting Air, made to the Class of Physical and Mathematical Sciences.

By M. BERTHOLLET *.

From the ANNALES DE CHIMIE.

WHEN Guyton had finished reading his treatise on the means of disinfecting air †, the class of Physical and Mathematical Sciences of the National Institute, struck with the importance of the object concerning which he had treated, nominated a commission, in which I was included, for the purpose of bringing these processes and means to greater perfection, and extending their utility.

Hitherto we have deferred performing the duty which was imposed on us, not because we had any doubt to clear up, any method to improve, but on the contrary, because Guyton has treated his subject with such attention, that we were reduced to the necessity of presenting you with nothing but an extract, which will contain only what is to be found delivered with much clearness in his work, and all that we are able to do will be to propose some means for accelerating the application of his processes.

It was in the year 1773, that Guyton first shewed that the muriatic acid gas had the power of destroying the infection of the air; till then no principle of physics had directed those who endeavoured to combat its influence in hospitals, in lazarettos, and in those accidental circumstances under which it produced its deleterious effects.

* In the name of the Commission of which he was member, with Citizens Hallé and Vauquelin.

† *Traité des moyens de désinfecter l'air, de prévenir la contagion, et d'en arrêter les progrès*, par L. B. Guyton Morveau, de l'Institut national, &c. Seconde Edition, 8vo. Paris, an XI. Benard, libraire, quai des Augustins, No. 31.

The

The fallacious indications of the senses were alone followed in the choice of the means which were employed; and these were principally fires, which could act but upon a very small portion of the air which required to be disinfected, and aromatic substances which produced very little real benefit, or which even had such effects as were contrary to the purpose intended: nevertheless, the combustion of sulphur, which was sometimes joined with these remedies, might have been able to answer the end proposed, if this substance had not been generally employed in too small quantity, and if it had not been most commonly mixed with resins and bitumens, which converted it into sulphurated hydrogene. The acetic acid, which was employed, must likewise be considered as an exception: when applied in the liquid state it is efficacious; but its small degree of volatility greatly confines the effect of its evaporation; and when it is made to undergo combustion, it ceases to have the properties which it owes to its acidity.

The experiment which Guyton made in a church at Dijon was as conclusive as could be desired: the building was very spacious, the infection was extreme, and yet a single apparatus in which muriate of soda was decomposed by sulphuric acid, a single operation, caused the infection entirely to disappear.

The same year the prisons of Dijon experienced the ravages of that fever which arises from a number of sick persons crowded together. The recent experience which had been made of the effects of the muriatic acid gas caused this remedy to be again resorted to, and in this instance it proved equally efficacious.

Now it was proved that the muriatic acid gas destroyed the effects of putrefaction, and those which proceed from a too great crowding together of sick persons, and which

render the most simple maladies fatal by the change which they produce in their nature. There is even reason to believe that all substances which have the power of corrupting the air, whatever might be their origin, would yield to the efficacy of this agent.

This ray of light illuminated the learned world. The Academy of Sciences, the Society of Medicine, the Council of Health, announced or prescribed this salutary process. The government has under different circumstances given orders for its being carried into execution in the military hospitals, and the vessels of the republic. Its success has always answered expectation wherever it has been put in practice.

This method of disinfecting air has been adopted in foreign countries, and especially in England, where the operations of Dr. (Carmichael) Smyth acquired much celebrity. We shall not enter here upon the discussion respecting the priority of the discovery; this belongs so incontestibly to Guyton, that it is unnecessary to say more on the subject; but Dr. Smyth has employed the vapours of the nitric acid, which shows that the property of disinfecting belongs to all the acids; it only remains to be examined which of them merits the preference.

Guyton has put this question to the test of experiment, by comparing the effects of the different acid vapours upon air infected by putrefaction. It results from his experiments: 1, That the muriatic gas has a greater expansibility in space than the nitric gas, so that its use is more sure for large spaces and especially for lofty halls; 2, that the disengagement of the nitric acid must be made without the aid of heat, lest it should become injurious to respiration by the nitrous gas which is formed by the effect of heat; 3, that for the same reason the

contact

contact of every metallic substance, that might decompose the acid, must be avoided.

From these considerations the muriatic gas merits the preference; but it has been accused of being offensive to respiration. This accusation appears to us to have little foundation: one of us can attest that conformably to the orders of the Committee of Public Safety, in the year 3 *, fumigations with muriatic acid were made every day in the L'Orient Man of War, which conveyed to Egypt that man whose splendid destiny has become our own, and no one complained of the slightest inconvenience. It is to be remarked that the fleet, in the whole of which the same process was used, accomplished its voyage without having any sick, although it was full of the soldiers; the case was the same with the frigates which brought back the first Consul.

However, if the sick should happen to be crowded together in low rooms, or if the nature of their diseases should afford reason to apprehend that their lungs might easily be affected, it would be preferable to employ fumigations with nitric acid.

Fourcroy had proposed, in 1791 and 1792, the use of the oxygenated muriatic acid for destroying the substances which produce infection not only in hospitals, but also in dissecting rooms; he even recommended it in all maladies in which a particular corruption takes place, such as ulcers, cancers, and for the destruction of all kinds of morbid virus. He has since insisted upon these properties of the oxygenated muriatic acid in several works, as well as in his courses of lectures to his medical pupils, in which he has even given particular lectures

* Instruction respecting the means of maintaining salubrity and purifying the air in military hospitals, drawn up by the Council of Health, conformably to a decree of the 2d Pluvoise, year 2.

upon the means of disinfection. This subject well deserves to be introduced, after the example which he has given, into the regular series of medical instruction.

Cruikshank has for several years past successfully employed fumigations with oxygenated muriatic acid in Woolwich hospital. It did not require all this to induce Guyton to subject this agent to comparative experiments, and he found it to be superior by reason of its great expansibility and the promptitude of its effect.

A theoretical consideration unites itself with the direct experiments, to entitle the oxygenated muriatic acid to the preference. The acids which are not decomposed, or which are decomposed only with difficulty, subtract the principle of infection merely by forming with it a new combination; but the oxygenated muriatic acid must destroy it by an effect analagous to that of combustion, and if the nitric acid can produce a similar effect, this property must be more active and more determined in the former.

The sharp and even dangerons odour of the oxygenated muriatic acid, when its vapours are condensed, affords no just ground for dreading their application. It is known that in various manufactures in which it is used, the workmen support it in a state of condensation, much more considerable than what is requisite for the purpose of disinfection.

A particular property of the oxygenated muriatic acid is, that the ingredients which produce it may be kept in a vessel, in such a manner that their reciprocal action becomes for a long time a source of disinfection by opening the vessel which contains them, without its being necessary to renew them or to apply heat. Guyton has procured himself this advantage in the preparation which he has designated by the name of *extemporaneous* oxygenated

nated muriatic acid. This is a mixture of oxyde of manganese and of nitro-muriatic acid. When the flask which contains it is opened, vapours are immediately disengaged which we may direct by transporting the vessel from place to place, which we may moderate, and which we may cause to cease at will. Guyton has had pocket apparatuses made similar to smelling-bottles, but which are of much more utility to those who use them for preserving them from infection.

Thus the oxygenated muriatic acid may be considered as the most efficacious of the means of disinfection, and the application of which is the most easy and varied.

The muriatic acid gas disengaged from muriate of soda by sulphuric acid may be considered as very efficacious, and may be employed with confidence, especially when large edifices are to be disinfected.

The nitric vapour disengaged without the application of heat from nitrate of potash by sulphuric acid has much efficacy, but it is less expansible: as it does not so easily affect respiration, it may be preferable in cases where the state of the lungs requires particular attention.

The gas formed by the combustion of sulphur would be too injurious to respiration; but it may be employed with advantage for fumigating wearing apparel and other infected substances.

The acetic and other vegetable acids are efficacious only when employed in the form of lotions.

The processes are so simple that they require only to be slightly indicated, to enable those who choose to employ them.

In order to disengage the muriatic acid gas by means of sulphuric acid, the proportion of muriate of soda and of sulphuric acid is 15 of the first to 12 of the latter. The

The salt is supposed to be in a state a little humid, and the acid of a specific weight of 17 to 10 of water.

This process must be performed in a different manner when we wish to disinfect a place which is not inhabited, and when we have to perform the operation in the midst of a number of persons, who are not to suffer inconvenience from it. In the first case we intercept as much as possible the exit of the gas, and perform the operation in a capsule of glass placed in a bath of hot sand. In the second case we entirely dispense with the application of heat, and move the apparatus about from place to place (which is advantageous in all acid fumigations); it will also be proper to add the acid only by degrees.

The quantity of ingredients must vary according to the extent of the space. Experience has shewn that three kilo-grammes of muriate of soda were sufficient to purify, by a single fumigation, the air of a church, the capacity of which was about 15,000 cubic metres. For a chamber of 35 cubic metres, only 19 grammes of muriate of soda and 15 of acid would be required.

The vapour of the nitric acid must be disengaged without the aid of heat; the proportions are 15 grammes of nitrate of potash, and as much sulphuric acid for a room of 35 cubic metres. If we operate in a space which requires larger quantities, we must use a greater number of capsules, and not accumulate the whole in a single vessel, in order that we may avoid the red vapours.

For the oxygenated muriatic gas, we mix two parts of pulverized oxyde of manganese with ten parts of muriate of soda, upon which we pour six parts of sulphuric acid previously diluted with four parts of water. The operation is performed without the application of heat. If these parts are decagrammes, the quantities specified will be sufficient for a room with ten beds.

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The quantities which have been indicated may appear very large in comparison with those of the substances which are employed in the preceding processes, but this difference proceeds from the circumstance that we obtain only a part of the decomposition when we operate without the aid of heat, principally on account of the water which we are obliged to add, in order to prevent too tumultuous a disengagement. It cannot be doubted that if, after the action in the cold was terminated, we placed the vessel upon a bath of heated sand, much smaller quantities would suffice.

Guyton directs, for forming the *extemporaneous* acid, to place four grammes of oxyde of manganese in a flask of three decilitres capacity, filled two-thirds with nitro-muriatic acid. After the vessel has been agitated, the gas is soon disengaged from it with vivacity; and this effect we may cause to cease when we think proper, by fixing the stopper of the flask, by means which may easily be imagined, in such a manner that it may resist the expansion of the gas. The same flask retains its property for a long time, without its being required to renew the ingredients.

Vessels of this kind, of a size proportionate to the effects which they are intended to produce, may be of great utility for maintaining a state of disinfection in halls, where the beds of a number of sick persons are crowded together, or which contain some other source of corruption, such as dissecting rooms. They are convenient for carelessness or indolence; for they require for a long time nothing more than to be opened and closed, or at most to be shifted from place to place.

How are we to account for it, that remedies so efficacious, so simple, and attended with so little expense, have been neglected in recent and destructive contagions?

To

To this question, the history of all discoveries will afford an answer; but it is our duty to seek for means of propagating the utility of this; and it will be proper first to examine what may be the limits of its application.

It is an established fact, that when sick persons are crowded together in a place where the air is not easily renewed, their malady degenerates and assumes a character of malignity, on account of which it has been designated by the names of hospital-fever, or prison-fever.

It is likewise known that healthy persons who are crowded together for a long time in buildings which have little ventilation, experience changes in their state of health, which approximate more and more to the nature of the abovementioned maladies, and which can be accounted for only from the diminution of the oxygenated gas in the air which they respire.

May it not be inferred from these facts, that even in the healthy state there is produced, either by transpiration or by respiration, a vaporous emanation which alters the vital properties of the air, in a manner analogous to that of substances which pass into putrefaction? In some individuals even this emanation is sufficiently strong to be disagreeable to the olfactory organs.

Thus this cause, which is followed by calamitous effects when it acts with energy, must produce, under circumstances less favourable to its action, changes in the state of health which are less distinctly marked, which disguise themselves, and the origin of which is attributed to other causes.

May we not ascribe, to the alteration produced by these vapours, the atrophy and death of children who are brought up together in one place, which has been too much attributed to the faulty nature of their diet? These

tender

tender victims may sink under a physical cause which would be powerless against more vigorous organs.

If we apply to those circumstances in which the emanations produce a doubtful effect, the means which we have found to be efficacious when these emanations act with great energy, and the harmlessness of which is equally proved, we may without inconvenience prevent and recognize all the effects of infection.

There are contagious diseases the material cause of which has an origin and character hitherto unknown; experience has already shewn that it has much analogy with those which produce another infection. It is therefore in the means which can destroy this, that we ought most to confide: thus the oxygenated muriatic acid must be expected to destroy the nature of these deleterious combinations, like it destroys that of colouring matters, odorous particles, putrid emanations.

Already has this property of the oxygenated muriatic acid been applied to ulcers, and to the external sources of corruption, with a success which ought to afford encouragement to make new experiments; and analogy ought also to direct these experiments to the putrid changes which take place in the stomach and the intestines, but with the cautiousness which the delicate fabric of these organs demands.

But while we point out this extension of the methods proper for disinfection, our object is merely to afford an incitement to trials which may confirm all their extent and utility; this may be considered as sufficiently established; and therefore what induces us to propose measures to government, is the efficacy of their application to the deleterious effects of putrid exhalations, and of those which proceeding from the crowding together of sick, or even of healthy persons, produce or aggravate

their diseases. All contagious principles have such a relation to these emanations, that they ought undoubtedly to be combated by the same means.

What we have established with respect to the human species is applicable also to the maladies of domestic animals, which appear to proceed from a peculiar infection of the air of ill-ventilated stables and sheds, or from a contagion.

We propose to the class to invite government; 1, To decree that acid fumigations be regularly made in the Lazarettos, in all the wards of the civil and military hospitals, and in those of the hospitals for the children of their country *(hospices d'enfans de la patrie)*, as well as in all the vessels of the Republic which shall be at sea; 2, to enjoin the professors of chemical medicine, and those of the veterinary schools, to give their pupils every year a practical lecture upon the means of disinfection *.

On Nickel. By Professor PROUST.

From the JOURNAL DE PHYSIQUE.

I THINK that it cannot be doubted that nickel is a metal *sui generis*. The sulphate of nickel, purified by the means which I am about to mention, has a sweet taste similar to that of the sugar of milk. The taste which it leaves behind it in the mouth is but slightly acrid and by no means disagreeable. Now this is not the taste of a sulphate of copper, for this, it is well known, is not merely disagreeable, but detestable.

* The class approved of this report, adopted the conclusions, and decreed that Citizen Guyton should be requested to give a succinct explanation of his method.

Copper

Copper completely abandons the acids when acted upon by sulphurated hydrogen. It is by this reagent that we separate it from the ores of cobalt and nickel, in which it almost always exists, though in small quantity. The colour of the solutions of nickel cannot be altered by sulphurated hydrogen; that of copper does not hold in it a moment. Nickel therefore cannot be confounded with an alloy of copper.

There is no solution from which arsenic or its acid is not precipitated by sulphurated hydrogen. If Bergman had thought of employing this happy means, the analysis of nickel would not have cost him so much trouble. When a current of this ore no longer produces a turbid yellowness in a solution of nickel, we may be assured that it no longer contains an atom of arsenic. The latter therefore is only a mineralizer, a metal naturally alloyed with the nickel, but not a constituent part of it.

Iron also abounds more or less in the ores of nickel; but when it has been well separated, the oxyde of nickel dissolves without residue in ammoniac, whereas that of iron does not pass into it. The iron is therefore no ingredient of the nickel; but when the oxyde of the latter has been reduced by simple heat to the metallic state, it exhibits a grey spongy substance, like that of platina separated from sal ammoniac, which acquires a lustre by friction, and is as susceptible of magnetic attraction as iron, if not more.

Copper destroys the ductility of iron. The native iron of Peru contains nickel, but there is not a suspicion of the presence of copper in it. Nothing is so ductile as this iron, or so little subject to rust.

Cobalt accompanies nickel in almost all its ores. It is this metal which by its red tinge alters the green colour of the preceding. Just as it is the nickel which gives a

 greenish

greenish cast to the sulphate of cobalt otherwise deprived of copper, of iron, and of arsenic; for it is by these three metals that cobalt and nickel are so disfigured in their solutions, and it is these that render the analysis of the ores of cobalt, which we find in one of the volumes of the *Annales*, unintelligible.

When the cobalt has not been well separated from the nickel, it is extremely easy to perceive it, first by the cast of the sulphate, which is not of a clean and vivid emerald-green; also by its solutions in ammoniac; for these at a moderate heat abandon all the oxyde of nickel, and that of cobalt which is much more strongly attracted maintains itself in them to such a degree, as to suffer itself to be condensed without being deposited: this combination is sufficiently durable, but I do not see in it the ammoniure of Brugnatelli. When the nickel has been carefully freed from cobalt, its solution in ammoniac, decomposed by heat, remains white, and the reagents do not discover an atom of cobalt in it. Copper, arsenic, and cobalt, are therefore as foreign to the existence of nickel, as they are to that of gold.

The arsenic, iron, copper, and the arseniates of all these metals which we find in a calcined ore of nickel, and which pass into its solutions, are the obstacles to the purification of this metal; they render the operation complicated, embarrass it with difficulties for one who is not well exercised in analyses of this kind, and throw upon it that obscurity which is to be observed in the analyses which I have just mentioned; from them proceeds the arseniate of cobalt which we extract from zaffre, a kind of oxyde which contains that of all the metals above-mentioned.

The following are in general the means which I have hitherto employed for freeing nickel from foreign substances.

Suppose

Suppose we have a grey ore, like that which is found in great abundance in our Arragonian cobalt mine, it never has the copperish cast of the Hessian Kupfer nickels, of the monastery of Poblet near Barcelona, and of Sierra Vermeja in Spain. It is calcined in the ordinary manner; afterwards it is moistened with residuums of ether; I suppose that we operate upon several pounds of oxyde. The collected leys present on examination, a solution of all the oxydes which I have mentioned, more or less arsenicated; but if the iron abounds, it is generally this metal that fixes the greater part of the arsenical acid.

By a proper employment of potash, it is easy, however little familiar one may be with the appearance of the arseniates, to precipitate all that of the iron; it is of a yellow-white colour, and always at the maximum of oxydation. It is that which falls the first by evaporation, which is performed without any risk in silver vessels; a little more is still separated.

Our solution thus purified still contains arsenical acid, but united with other oxydes, especially if the iron does not abound and the potash could reach them. Here we stop to pursue another course.

We cause the current of sulphurated gas to pass through the liquor collected in one or more flasks, and, as long as we see the yellow deposition or the orpiment increase in quantity. This process may last for eight days and more, but it must not be discontinued, unless a sample of the liquor poured into a glass of hydrosulphurated water no longer becomes turbid in it. This operation is neither inconvenient nor expensive, as we use in it only sulphurated iron and filtrated residues of ether for the concentration, as I have said above; moreover we precipitate the copper.

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I have sometimes varied this process by beginning with the employment of the sulphurated hydrogen: in this case, the iron, which quits the arsenical acid with much greater difficulty than the other metals, resists for a greater length of time the action of the reagent, and we may then precipitate it in arseniate by potash.

In employing the sulphurated hydrogen, we completely get rid of the arsenic and the copper; but with regard to the iron, the depuration is only commenced: and what remains after this operation is found reduced from the maximum to the minimum, which augments its affinity for the acids. In this state it would be very difficult to separate it from the other metals, at least by economical means; the only means which I have found is to raise it again to the maximum with the aid of a little nitric acid; thereby the affinity of the iron for the acids is reduced below that of the oxydes of nickel and of cobalt, which occupy the solution.

In order to bring the iron again to the maximum, and to insure the work in the large way of all its solutions, we heat some ounces of it in a mattrass with a little nitric acid; afterwards, in the liquor thus prepared we cause, with the aid of potash, some grains of precipitate to be formed, and we heat it in order to see whether this precipitate, which must not disappear if the liquor is saturated, does not change colour; that is to say, if it does not assume the yellowish cast, which indicates the presence of iron; if iron exists in it, we are assured that the oxydes of nickel and of cobalt occasioned by the potash entering into solution, will occasion the separation of the yellow oxyde. If this oxyde no longer appears, the solutions contain only nickel and cobalt, and their precipitates which may assume a particular colour will no longer appear with the tinge of the oxyde of iron; and the

the test of ammoniac, which dissolves these oxydes without residuum, perfectly satisfies us whether we have at length got rid of the two metals which form the greatest impediment to the depuration of the two others.

During this process it happens that the sulphate of nickel changes its state and assumes a new character, which remarkably facilitates its purification; for the additions of potash, and which frequently occur in processes of this kind, introduce a portion of sulphate of potash with which that of nickel combines by the effect of an affinity which may be compared with that which is observed in alum. The sulphate of nickel yields prismatic crystals more than two inches long in the spontaneous evaporations, and it requires but little water in order to crystallize; but if we evaporate the solutions which have been treated by the above processes, we find that they afford crystals of a quite different configuration, and which besides require much more water to keep them in solution.

The first are of a dirty green colour, on account of the yellow which the iron introduces into them; they effloresce and become opaque. The second exhibit a perfect transparency; they are unalterable, and their tinge is that of the finest emerald. As they require much more water for their solution, they also crystallize with the greatest facility; but they contain cobalt. The following is the method which I have found the most advantageous for depriving them of this metal.

The sulphate of cobalt, which is infinitely less disposed to crystallization than that of nickel, tends to remain in the mother-waters, and we remark in it the colour of lees of wine which increases in proportion as we separate the crystals of nickel, and at the end even

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the last mother-waters are nothing but cobalt. By thus repeating the solutions and crystallizations we almost entirely separate it. Nor do I doubt that it may be completely accomplished with a little patience. This is by no means a troublesome labour. My sulphate of nickel has already undergone more than twenty crystallizations, which have all hitherto left me a little cobalt; and if my avocations would have permitted me, I should at this moment have it of the degree of purity, to which it will infallibly be brought by repeated crystallizations. I have more than two pounds of crystals of nickel in this state. In order to assure ourselves of the progress of its purification, we throw some crystals of it into ammoniac; the vitriolated tartar falls in a white powder, whilst the oxydes pass into solution. We evaporate with a gentle heat; the oxyde of nickel separates the first, but what I have left is of crimson colour. My sulphate therefore still contains cobalt.

On dyeing with Madder and dyeing Adrianople Red and other durable Colours upon Cotton and Linen Thread, with some Remarks on spontaneous Inflammations. By JEAN MICHEL HAUSSMANN. *In addition to a former Memoir, by the same Author.*

From the ANNALES DE CHIMIE.

IN order to enable us to proceed to dye cotton and linen thread all kinds of durable colours, the only object required is to fix upon such thread, in any manner, a greater or less quantity of alumine, after having given them a slight oily layer; however the complete success of

of the result depends upon certain modifications to be observed in the processes.

The numerous experiments which I had made in dyeing, had so familiarized me with the processes in the small way, that at last I did not think myself deficient in any. Not till after I had published my memoir on dyeing with madder, which was inserted in the Annales de Chimie, I experienced difficulties in the application of the oils, when the operation was performed upon a larger scale; the linseed oil which had always given me a milky mixture in limited proportions with its alkaline solution of alumine, then separated quickly when I attempted to make a large quantity, and the impregnation of the skains became impossible under such circumstances. The case was the same with all the other fat oils; fish-oil however keeps a considerable length of time mixed, but its smell is too disagreeable.

In order to remedy the inconvenience of the separation of the oil in the alkaline solution of alumine, I had recourse to the drying oils, that is to say, boiled with metallic oxydes. Linseed-oil boiled with cerusse, minium, or litharge, with the aid of water, in order to prevent combustion, dissolves a considerable proportion of oxyde of lead, and keeps mixed with the alkaline solution of alumine, in the milky form all the time that is necessary for the impregnation of the skains. When this mixture is employed in the proportions and the manner which I have indicated in my memoir, and the rest of the process which I have described strictly followed, fine and durable colours cannot fail to be obtained. However, simple as this process is, I can no longer recommend its use, as it exposed me to the danger of being burnt, and that in the following manner.

Intending to see whether red cotton, which had not the requisite durability, could acquire it by being impregnated with a mixture of alkaline solution of alumine, and an excess of boiled linseed-oil, and dried, afterwards boiled for a very long time in bran-water, I mixed the alkaline solution of alumine in the proportions of an eighth, twelfth, and sixteenth part of boiled linseed-oil. I afterwards impregnated with this mixture some dozens of skains of dyed cotton, which after having been dried in the open air during a whole day of last summer, was placed under the window of my closet upon a straw chair. Finding myself indisposed that day, I went to bed at 7 o'clock in the evening, without thinking of my cotton. My children came an hour after me into the same closet, to look for some papers, and did not perceive in this cotton any heat or smell that indicated a commencement of combustion. Every person in the manufactory was already asleep, when one of the watchmen of the bleaching-yard, seeing my closet entirely illuminated, raised the cry of fire and awakened us between twelve and one o'clock in the morning. My sons knowing that I could not rise from bed, and unwilling to lose time in seeking the key, broke open the door of the closet, which is in a separate and uninhabited building: they entered, notwithstanding the thick smoke and the insupportable smell of the oily combustion, and found the chair with the cotton in such a conflagration, that the flames, which rose as high as the cieling, had already broken the panes and set fire to the wood-work of the window. They immediately conjectured that this fire could arise only from a spontaneous inflammation of the cotton, impregnated with boiled oil, as no one ever entered the closet either with smoaking-pipes, or with any other burning substance. Perceiving that many persons in the

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manufactory hesitated to give credit to this mode of explanation, I again impregnated some dozens of skains of old cotton which had succeeded ill in the dyeing, in the same manner as I had done the cotton which was burnt. After having likewise dried these skains in the air, and seeing the weather incline to rain, I had them hung upon a cord drawn above the watch-house; and recommended to one of the watchmen to observe the cotton every quarter of an hour, and to throw upon it a bucketful of water when he should see that it began to be heated; but this man, not believing the spontaneous inflammation of the cotton to be possible, as he himself confessed to me, walked over the manufactory without ever looking to the watch-house: at last, however, he returned to rest himself, when by the great light which he perceived, he was convinced of what I had foretold him in case of negligence; and, seeing that the cotton as well as the cord were burnt, he took the bucket of water in order to extinguish the supports which were already on fire.

Though these two accidents had nothing in them to surprise me, I could not however forgive myself for the first, unless with a view to the prevention of similar dangers. I had made public fifteen years ago, in the tavern at Colmar, experiments upon spontaneous inflammations. I pointed out the probabilities of the combustions which might be occasioned by heated bodies, or by such as tend to become heated, and which are inconsiderately placed in situations to which the fire may communicate. The substances of this kind which I mentioned to those of the persons present, who were not sufficiently acquainted with the phenomena of spontaneous inflammation, are roasted coffee and cocoa, fermenting plants, ointment made with metallic oxydes and inclosed whilst hot in wooden barrels, bales of raw cotton, as well as woollen

yarn or cloth heaped together at a high temperature, and even linen when put hot from ironing into the presses; finally, all kinds of bodies impregnated with boiled oils, such as silk and skains of cotton. Moreover, I shewed them that, under all the circumstances in which the oxygene of the air is rapidly attracted and absorbed from any cause, the caloric which served the oxygene for its base, and gave it the qualities of gas or elastic properties, is disengaged in such abundance, that if the absorbing body is susceptible of inflammation, or if combustible substances surround this body, a spontaneous inflammation will take place.

In order to confirm to those of the company who were not familiar with chemical experiments, the theory of these kinds of inflammations, I performed the following experiments: 1, the incandescence of a mixture of iron-filings and sulphur kneaded together with water; 2, the inflammation of boiled linseed-oil by the concentrated acid of nitre; 3, the inflammation of phosphorus in the air of the atmosphere as well as in pure oxygen gas, and placed for this purpose in a capsule of porcelain upon boiling water, in order to remove the particles from each other by fusion without having recourse to friction; 4, the inflammation of the phosphorous hydrogene gas by the contact of the atmosphere and in pure oxygen gas; 5, the reduction into an igneous charcoaly mass, produced by the action of the atmospheric air, with bran torrefied, and put whilst still hot in a canvas bag, the texture of which was not very close.

I am not ignorant that the essential or volatile oils become resinous, and that the drying oils boiled with metallic oxydes thicken and harden in the same manner by combination with oxygene. It was for this reason also that my skains, impregnated with a mixture of boiled linseed-

linseed-oil, were exposed for a whole day to the air, spread out separate upon poles; but I then supposed them to be saturated with oxygene, and consequently incapable of producing the slightest accident. I thought myself so secure in this respect, that I several times dried a considerable quantity of impregnated cotton in warm rooms; and it was mere accident that it was never deranged till the moment when it was washed for being dyed. It is however possible that the proportion of a thirty-third part of boiled linseed-oil mixed with the alkaline solution of alumine, may be insufficient for exciting spontaneous inflammation in the skains heaped together after having been dried. If therefore we should be tempted to employ, on account of the simplicity of the process, a mixture of boiled linseed-oil, with the alkaline solution of alumine, it would be necessary to use the precaution of leaving the skains spread out and separated upon the poles till they are to be washed previous to the dyeing, which conjointly with the refreshing operation completely removes all the excess of oil, so as to leave only the portion which is entirely saturated with oxygene; after which there is nothing more to be feared.

Since the publication of my memoir, I have also convinced myself that the most simple refreshing of the Adrianople red, by which we procure the most lively and durable colours, consists merely in long ebullition in bran-water, performed in a cauldron closed with a cover, which is provided with a tube in the middle for giving vent to the vapours, and preventing the vessel from bursting; only care must be taken to renew the water as often as it shall have become red, that is to say, two or three times in the beginning of the ebullition; without this

this precaution the skains will continually take up again the fallow particles which the bran-water carries off, and we shall never obtain brilliant tinges.

We may entirely guard against every danger without detracting much from the simplicity of my process, whether we heap up the skains or not; for this purpose nothing more is necessary than to put upon them, at twice, a layer of olive-oil in a state of great attenuation, after having previously well leyed, washed, and dried them; with this view we procure a ley of carbonate of potash or of soda, which indicates one degree, or a degree and a half, by the areometer for saltpetres; we afterwards endeavour to mix with it some drops of olive-oil, in order to see if it produces a milky mixture, or if the oil ascends in its natural state, and swims at the top of the ley; for the alkaline carbonate being able to contain more or less of heterogeneous parts, it will be necessary in this case to weaken or strengthen, by a new portion of alkali, the ley which it is absolutely necessary should assume a milky appearance in the trial with oil. When the ley has the proper proportions, we mix at first by little and little, and afterwards more quickly, continually stirring it, thirty-two parts of it with one part of olive-oil: this milky mixture keeps a considerable length of time, and, if we perceive that the oil tends to swim at top in the form of cream, the mixture must be stirred anew. The impregnation of the skains must be committed to the workmen who are the most practised in this operation, as the exact distribution of the oily particles has much influence upon the equality of the colours. Every workman should take into a vessel only so much of the milky mixture that he can stir in it easily, and with as much dexterity as possible, the number of skains which he shall be able to

press

press and wring out with facility; he must continue this labour, taking always the same number of skains, and the same quantity of milky mixture; he must pour every time what he has pressed out into a separate vessel, and supply again by eye-measure the quantity of oil which the skains shall have absorbed, unless the small value of this residuum, which contains but very little more oil, should induce him to reject it. The impregnation may indeed be made in the whole mass of milky mixture, but then it will be necessary to continue to replace by eye-measure the requisite quantity of olive-oil, which the skains will have absorbed, as soon as it shall be perceived by the diminution of the intensity of the milky mixture. These manipulations, however, are easily acquired by practice. After having dried all the skains together, they must be impregnated a second time like the first, without previously washing them, and when they are dried we may immediately, without previous washing, and in the manner which I have detailed in my first memoir, impregnate them once, twice, or thrice, in the alkaline solution of alumine, quite pure and without oily mixture; we shall then obtain, in dyeing them, colours more or less deep in proportion to the number of impregnations.

In order however to obtain light colours, and at the same time of the greatest equality, it will be better to use three impregnations, properly weakening the solution of alumine; we may also endeavour to impregnate the skains three times successively in this concentrated or weakened solution, without previously washing them; thereby we shall greatly shorten the manipulations, which are tedious and troublesome; but in this case it will be necessary to examine the solution from time to time, in

order

order to see if what the impregnated and dried skains discharge in it does not render it too strong.

In dyeing red colours over again, we shall immediately discover whether they have been freshened by means of boiling bran-water, or by means of soaps and alkalies; in the first case they become deeper by attracting more colouring parts of the madder; and in the second they become weaker and lose the excess of alumine, without which a repeated dyeing produces no more effect. We may prevent the loss of this excess of alumine by substituting in place of the soaps and alkalies, for producing the crimson tinges, a portion of the alkaline solution of alum to be added to the bran-water towards the end of the reviving. The true Adrianople reds become much deeper in dyeing them over again, and they are then turned brown by the test of ebullition in water alkalized by ashes; the same reds change very little in it before they have been dyed over again. Generally the reds are browned more or less disadvantageously in proportion to the longer or shorter time they have been boiled in the reviving. As the true Adrianople reds have a strong smell, it is possible that the Turks may use fish-oil, which they add directly to the alkaline solution of alumine, or which they mix with a very much-lowered ley of alkaline carbonate.

The processes for the Adrianople reds may be varied *ad infinitum*; for, in whatever manner and by whatever acid or alkaline solvents we shall have fixed the alumine upon the skains, after having given them a slight layer of some oil, we shall not fail to obtain reds more or less vivid in proportion to the precautions which shall have been employed in the maddering and the reviving.

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The reason why the oils, which combine very easily with the caustic alkalies to form soaps, do not admit of admixture with the concentrated leys of alkaline carbonates, whilst they form kinds of factitious milk with the same ley weakened to an extreme degree; the reason of this, I say, seems to me the more difficult to be explained, as one might at least suppose a tendency to the combination in these kinds of milky mixtures; a simple suspension of the integrant oily molcules that should take place in the weakened ley preferably to the concentrated, is not less difficult to be accounted for.

It still remains for me to apologize for a mistake which I have committed with respect to the manufacture of real Adrianople red cotton used in other manufactories: what had been shewn me of it was only of the worst quality, and I have since seen such as was equal to the most beautiful and durable which could be produced; so that I am inclined to believe that the merchandize of the Turks, like that of all other nations, depends upon the price which the purchaser will put upon it.

I must also not forget to observe that among my cotton which was burnt, there was both times some which was impregnated with the mixture of the weak ley of carbonate of soda, and boiled linseed-oil in the proportions of an eighth, twelfth, and sixteenth part: it would now remain to be determined whether this cotton inflames sooner than that which is impregnated with a mixture of an alkaline solution of alumine, and boiled linseed-oil in the same proportions. As this latter mixture is capable of attracting a little moisture from the air, I am rather inclined to think that the cotton treated with the first would inflame more easily.

The experiments which I have pursued upon the use of gall-nuts in the manufacture of Adrianople red, lead

lead me to believe that it is by means of the formation of a gallate of alumine that we fix the alumine upon the cotton, to separate afterwards from it the gallic acid by an alkaline carbonate, before we proceed to the dyeing. As soon as I shall have arrived at certainty respecting such a supposition, I shall not fail to publish the experiments.

On Spontaneous Inflammations.

By G. C. BARTHOLDI, *Professor of Natural Philosophy and Chemistry.*

From the ANNALES DE CHIMIE.

THOSE inflammations are termed spontaneous which take place in combustible bodies without their being in immediate contact with an ignited substance.

Such combustions may be occasioned by different causes, the principal of which are:

1. A considerable friction.

2. The action of the sun.

3. The disengagement of caloric produced in substances, though not themselves combustible, yet in proximity with other combustible bodies to which they may communicate such a degree of heat as to cause them to be inflamed by the contact of the air.

4. The fermentation of animal and vegetable substances accumulated in large masses, which are neither entirely dry, nor too wet, such as hay, dung, &c.

5. The accumulation of wool, cotton, and other animal and vegetable substances, covered with an oily matter, especially with a drying oil.

6. The

6. The boiling of linseed oil for printers-black, of varnishes, and in general of every kind of fat.

7. The torrefaction of different vegetable substances.

8. The sulphurated and phosphorated hydrogen gases, which disengage themselves in several natural operations, and of which the latter especially becomes inflamed by the mere contact of the atmospheric air, even at a low temperature, and often presents itself at the surface of the earth like a small flame, known by the name of *Ignis Fatuus*, in places which inclose animal substances in a state of putrefaction: if there are at that time other combustibles in the place where the disengagement takes place, they may easily become kindled.

9. The phosphuret of lime and of potash, which may be formed in the preparation of charcoal, especially in that of turf and of some kinds of wood which grow in marshy situations. This charcoal when it is wetted, or merely by attracting the moisture of the air, forms phosphorated hydrogen gas, which by the contact of the atmospheric air inflames, and may set fire to the whole mass of charcoal.

10. The phosphorus which is formed sometimes, though rarely, in the conversion of different kinds of wood into charcoal, without its being combined either with lime or with potash in the state of phosphoret. These charcoals do not inflame spontaneously at the ordinary temperature of the atmosphere, but they may produce a detonation when they are struck upon together with nitrate of potash, or with some other nitrates or metallic oxides to which the oxygene has a feeble adhesion, and which are in a state of thermoxyde, containing much latent caloric.

1. *Friction.*

It is generally known that when two bodies are rubbed against each other they become heated; the intensity of the heat which they produce depends upon various circumstances, and varies chiefly according to the duration of the friction, the nature and the surface of the bodies rubbed. When the friction takes place between combustible substances, as wood, the heat which it excites may often be sufficient to inflame them; if the bodies are not combustible, like stones, or of little combustibility, like metals, they do not become themselves inflamed, but they may communicate to other combustibles which surround them such a degree of heat that these are inflamed by the contact of the atmospheric air.

Dr. Palcani having repeated the experiments which have long been known, for obtaining fire by rubbing two pieces of wood together, giving to one of them the form of a tablet, and to the other that of a bobbin or cylinder, it will be sufficient to give here the results of some of his experiments, in order to shew that in the construction of instruments more attention ought to be paid to the choice of the woods which are intended to rub against each other.

Box-

2 Cylinders.	Tablet.	Time.	Effect.
Box-wood rubbed against	Box-wood during	Five Minutes,	Sensible heat.
The same - - - - -	Poplar - - -	the same - -	the same.
The same - - - - -	Oak - - - -	the same - -	the same.
The same - - - - -	Mulberry - -	Three Minutes,	Considerable heat and smoke.
The same - - - - -	Laurel - - -	the same - -	the same.
Laurel - - - - - -	Poplar - - -	Two Minutes,	the same.
The same - - - - -	Ivy - - - -	the same - -	the same.
Ivy - - - - - - -	Box - - - -	Three Minutes,	the same.
The same - - - - -	Wallnut - - -	the same - -	the same.
Olive-tree - - - - -	Olive-tree - -	the same - -	the same.
Mulberry - - - - -	Laurel - - -	Two Minutes,	Considerable heat, smoke, and blackness.
Ash - - - - - - -	Oak - - - -	Five Minutes,	Sensible heat.
The same - - - - -	Fir - - - -	the same - -	the same.
Pear-tree - - - - -	Oak - - - -	the same - -	the same.
Cherry - - - - - -	Elm - - - -	the same - -	the same.
Plumb - - - - - -	Apple-tree - -	the same - -	the same.
Oak - - - - - - -	Fir - - - -	the same - -	the same.

If

If we vary the experiment, and rub a cylinder of one of these woods between two tablets of the other; for example, a cylinder of poplar between two tablets of mulberry-wood, the augmentation of the rubbed surfaces which are in contact with the air produces a much more considerable heat, and almost all the woods above mentioned take fire.

The effect of the friction varies also, according as the woods which are used, especially when they are of the same kind, are rubbed together in the direction of the grain, or so that the fibres of the wood cross each other. In the first case, the friction and the heat are much more considerable than in the second.

In large machines, where there is much friction, we prevent the heat by conveying continually a stream of cold water over the surfaces which rub against each other; in ordinary machines, and in carriages, coaches, &c. it is diminished by covering the surfaces between which the friction takes place with an oily matter. There are many instances of carriages and other machines, which have been kept in violent motion during the heat of summer, having become inflamed on account of neglect in greasing. The grease when it hardens upon the surfaces which rub each other, instead of diminishing the friction, augments it, and as this covering is very combustible, it renders spontaneous inflammation still more easy. Thus, in many circumstances, it is preferable to rub the machines with soap, talc, plumbago, or other substances which, without being oily, are very unctuous to the touch.

2. *The Action of the Sun.*

We produce the most intense heat, we set fire to all kinds of combustibles, we melt the most refractory substances, by concentrating the solar rays with convex glasses

glasses or with concave mirrors. It may happen that other substances may be placed in circumstances under which they produce, against our will, effects similar to those of burning glasses and mirrors. Though these effects are more physical than chemical, it is however of essential utility to point them out, in order that the danger which they may occasion may be guarded against. There are instances of fires occasioned by glass vials filled with water, and exposed to the sun in an apartment. When the form of the vessel is nearly similar to that of a lenticular or spherical glass, the rays are refracted, and uniting in a focus produce a heat capable of inflaming the combustible bodies upon which they fall.

3. *Heat excited in non-combustible Substances.*

It is known that quick-lime immersed in water, or merely wetted, produces a considerable heat. This effect has even been successfully employed for heating in a cheap manner apartments, green-houses, beds, &c. This property which quick-lime posseses of disengaging a large quantity of caloric by the contact of water, and the no less dangerous one of dissolving or corroding animal substances that are immersed in it, require the greatest precautions when considerable deposits of quick-lime are formed. In order to preserve it, it is necessary that it should be guarded against the contact of the air, and of every kind of moisture, and especially that all combustible substances should be removed from it, such as wood, hay, straw, &c. which might become spontaneously inflamed if the lime contracted the least humidity. The journal of the Haute-Saone gave an account, last year, of a barn having been burnt down, one of the wooden partitions of which had taken fire, in consequence of a heap of quick-lime, which was intended for

for repairs in the farm, having been imprudently laid against it.

A great number of analogous phenomena occur in nature, in which bodies, by changing their composition, or by entering into new combinations, become heated to such a degree, or disengage such a quantity of caloric, that they may set fire to other combustible bodies which surround them.

4. *The Fermentation of Animal and Vegetable Substances.*

Most animal and vegetable substances when accumulated in large heaps, whilst they still retain moisture, pass into fermentation, a change takes place in their composition, and they frequently become heated to such a degree as to take fire. Thus spontaneous inflammations have been observed in magazines of hay, of turf, of flax, of hemp, in stacks of hay or straw, in heaps of old linen in paper-manufactories, &c.

Hay is the substance which principally requires precaution; when it is made in a rainy season, it is generally housed before it is entirely dry, and in this state it is the more liable to ferment and become inflamed. When we perceive that a stack of hay is in a state of fermentation, we must be very careful not to throw it down too rapidly, but carefully take off the outermost layers one after the other. When an opening is made in the middle of a stack of heated hay, it almost always happens that it suddenly takes fire.

However, nothing is more easy than to prevent these destructive accidents; it will be sufficient, if we apprehend that the hay which we are about to house or stack is not sufficiently dry, to sprinkle between each layer a few handfuls of kitchen-salt (muriate of soda). It would be very ill-judged economy to shun this trifling expense; for

for the salt, by absorbing the moisture of the hay, not only prevents its fermentation and consequent inflammation, but it also gives to this fodder a taste which excites the appetite of the cattle, which aids their digestion, and preserves them from a multiplicity of diseases.

In the intense heat of summer it has sometimes happened that heaps of dung have become spontaneously inflamed; one ought therefore in the summer season to be very careful to moisten the dunghills from time to time, and to keep them at a certain distance from the dwellings, both in order to prevent fires and with a view to health.

5. *The Accumulation of Animal and Vegetable Substances covered with Oil.*

If animal and vegetable substances heaped together in large quantities may become inflamed by the heat which their decomposition produces, this accident is still more to be dreaded when they are covered with oily matters, and especially with a drying oil.

Besides the accident which happened in the manufactory of Lagelbart, and of which our colleague Haussman has given an account to the society *, and the fire which took place in one of the finest manufactories, at Ste-Marie-aux mines, there are many other instances of wool, woollen-stuffs, pieces of cloth that have not yet been scoured, having become inflamed in the warehouses, when they were folded together, and even during their transportation from one place to another, when they were in considerable heaps; and this accident is principally to be apprehended when in the manufacture of these cloths linseed-oil is employed, or any other oil, either naturally of a drying nature, or rendered so by the oxyde of lead.

* See the preceding paper, page 42.

In the cloth manufactories therefore no oil should be used for greasing the wool but that of olive, or at most that of colza.

It sometimes happens in boiling flowers and herbs in oil, as is done in several pharmaceutical operations, that these herbs which have dried in the oil, after having been taken out, become spontaneously inflamed; care must therefore be taken not to heap up these herbs near to other combustible bodies.

There are several instances of vessels having been set fire to in the sea-ports, either by the spontaneous combustion of heaps of cordage covered with much tar, or of a mixture of linseed-oil boiled with lamp-black and inclosed in a bag.

6. *The boiling of oily Matters.*

In the preparation of some varnishes, as in that of printer's black, in which linseed-oil is commonly used, which is boiled to a certain consistence, it frequently happens that the oil becomes inflamed if the necessary precautions are not taken: the same effect takes place if in boiling butter, hogs-lard, or any other kind of fat, we heat them too strongly, so that in these operations we ought always to remove every other combustible substance, have a lid in readiness for covering the vessel as soon as inflammation has taken place, and especially take care not to pour water upon the flames, which, instead of extinguishing them, would only give them more expansion and activity.

7. *Torrefaction.*

There are many vegetable substances which by torrefaction acquire the property of spontaneous inflammation if they are inclosed in canvas bags, which admit the con-

tact

tact of the surrounding air; such as saw-dust, burnt coffee, the farina of gramineous plants, and of leguminous fruits, as beans, lentiles, pease, &c.

There are several instances of fires having arisen in stables from a bag of roasted bran applied to the neck of a sick animal, which became spontaneously inflamed. The country people who in some diseases of their cattle obstinately persist in the use of this remedy, in the place of which they might substitute others of a more efficacious and less dangerous nature, ought at least to be careful not to inclose the bran in canvas, nor to apply it too hot or too much roasted.

The brewers, after having caused the barley and other grain, which they use for making beer, to germinate, dry it in a kiln, except that which is intended for pale beer, aud they generally roast it more or less in order to give the beer a more or less deep colour. When after the grain is taken from the kiln it is put, whilst still warm, into sacks, it sometimes happens that it becomes heated and takes fire, which has more than once occasioned conflagrations in breweries.

8. *Sulphurated and phosphorated Hydrogen Gas.*

The cause of subterranean fires and volcanos is generally attributed to the decomposition of the pyrites or metallic sulphurets inclosed in the bowels of the earth. These pyritous masses are decomposed by the contact and concurrence of water and air, and the decomposition is always accompanied with a great expansion of caloric, and a disengagement of a very inflammable gas, termed sulphurated hydrogen gas. This gas inflames at a high temperature, and may communicate inflammation to the sulphur of the pyrites, to the pit-coal, and the bituminous matters which generally accompany them.

Such inflammations are sometimes observed about coal-mines. In digging the coal, veins and insulated pieces of pyrites are frequently met with; as these pyrites always communicate a bad quality to the coal, the miners generally put them apart, and remove them from the mine; if these heaps of pyrites mixed with coal are then exposed to the alternate action of the sun and rain, they become heated and take fire. Great care ought therefore to be taken to keep these heaps of pyrites at a distance from all combustible substances, to which they would necessarily communicate the inflammation.

There are many operations in nature in which sulphurated hydrogen gas is formed, but it often contracts new combinations as fast as it is formed, dissolves itself in water, or is disengaged at a temperature too low to enable it to take fire.

When posphorus is boiled in a solution of potash or of lime, phosphorated hydrogen gas is disengaged, which, being much more combustible than the sulphurated hydrogen gas, inflames at a low temperature as soon as it comes into contact with the atmospheric air. This gas, which in chemical experiments affords the beautiful spectacle of a lambent fire upon the surface of water, is naturally produced by the putrefaction of animal substances buried in the ground. The lights which are frequently seen to issue from the earth, and which are known by the name of *ignes fatui*, arise merely from the disengagement of this phosphorated hydrogen gas. As these fires commonly present themselves in open ground, in places where they do not come into contact with dry combustibles, they rarely produce bad accidents; but they are sometimes also disengaged in woods, and it may happen in very hot summers, when the herbage and bushes are entirely parched, that the burning gas may come into

contact

contact with these combustible substances, kindle them, and thus set fire to a whole forest. Such unfortunate accidents ought therefore not to be attributed too lightly, or without sufficient proofs, to the malice or co-operation of men, as they are sometimes only a result of purely natural causes.

9. *Sulphuret and Phosphoret of Lime and of Potash formed in the Combustion of several Vegetables.*

Sulphur is formed whenever gypsum (sulphate of lime) or any other sulphate, whether earthy or alcaline, is strongly heated with charcoal, wood, or in general with any combustible substance, which by the action of heat is reduced into charcoal. These same salts form sulphureous waters when the remains of animal or vegetable substances are left to lie in water in which they are dissolved; so that it frequently requires only a little sulphate of lime, or other sulphuric salt, in order to impart to a standing water a smell and taste of sulphur.

The pyrophorus is obtained by calcining alum of commerce, or sulphate of potash, with sugar, flour, or some other matter which is reduced to charcoal.

The inflammation of the pyrophorus, which is kindled by the mere contact of moist air, proceeds merely from the sulphuret of potash, which, as it attracts the humidity of the air, becomes heated to such a degree that it kindles the charcoaly matter which surrounds it, and which, being in a state of great tenuity, is the more disposed to burn.

But as many of our ordinary combustions contain sulphuric salts, it may happen that in their combustion there is sometimes accidentally formed some pyrophoric matter which remains in the residue of the combustion, especially if the combustible is not entirely consumed, and a part

a part of it is reduced only to charcoal, as frequently occurs in fires where the fuel is not burnt in grates, and where the ashes are not separated from the charcoal. Houses are known to have been burnt by ashes mixed with charcoal, which had been taken too soon from the fire-place, and put into situations where they were surrounded with combustible substances, to which they set fire by a spontaneous inflammation. Fortunately these causes of conflagration rarely present themselves; for the pyrophorus does not long retain its property of inflaming, and it is frequently decomposed a short time after it has been formed, without producing any troublesome accident; however, we ought always to be careful not to place ashes recently burnt, and which are still mixed with coal in places where they may communicate with combustibles.

The formation of a pyrophoric matter is remarked principally in the preparation of the soda of commerce, which is obtained by the incineration of several maritime plants which contain much sulphate of soda, and which, in burning, always afford a certain quantity of sulphur, which is more or less considerable according to the manner in which the operation is directed.

The formation of the phosphuret of lime has much analogy with that of the sulphuret of lime. Though the phosphoric acid does not exist so frequently in vegetables as the sulphuric acid, it however exists in them in a larger quantity than has hitherto been supposed. It is principally found in most of the plants that grow in marshy situations, in turf, and in several white kinds of wood. When these woods are reduced to charcoal, there is sometimes formed a small quantity of phosphorus, which may remain combined with the same bases which retained the phosphoric acid previous to the combustion; the

the phosphorus may, by contracting new combinations, be no longer capable of producing any accident, but it may also happen, by the concurrence of a variety of circumstances, that the charcoal, impregnated with any phosphuret, being exposed to the action of a warm and moist atmosphere, disengages phosphorated hydrogen gas, which, by the contact of the atmospheric air, may be kindled, and communicate the inflammation to the mass of charcoal.

Two instances of this kind of spontaneous combustion took place at the powder manufactory of Essone, in the years 8 and 10. The first time the fire broke out in the coffer of the charcoal-bolter; and the second time the magazine of charcoal took fire without any possible suspicion of any other cause than a spontaneous inflammation. The different reports given upon these two events have been inserted in the public journals; but the explanations which have been given of them are not sufficiently satisfactory. It appears very probable that they were occasioned by some phosphorus contained in the charcoal; and this explanation receives additional strength from the circumstance that the black alder wood, which is used at Essone, as well as in most powder-manufactories, and which in many respects is preferable to other woods for that purpose, contains phosphoric acid, at least that does which grows in our parts.

Turf-charcoal has begun to be employed for various economical purposes, but as it is much disposed to spontaneous inflammation, it is necessary to warn against its use, and at least it ought to be stored up with much precaution. It has happened in Paris and in other places that magazines of this charcoal, which were exposed to the air, became inflamed by the combination of the heat and rain.

10. *Phos-*

10. *Phosphorus sometimes contained in Charcoal.*

It may also happen that the small quantities of phosphorus which is sometimes formed in the conversion of different kinds of wood into charcoal, without uniting either with lime or with potash, remains combined with the charcoal, which then does not disengage phosphorated hydrogen gas, and does not easily become inflamed by the mere action of water or moist air, but which may produce a violent detonation when struck upon with saltpetre (nitrate of potash). It is very probable that the three successive explosions which took place in the powder-manufactory of Vonges were partly owing to a similar cause.

Charcoal has in general a great influence upon the different products of nature and of the arts. It is frequently remarked in forges and founderies, that the products vary according to the nature of the charcoal employed. Generally the bad quality, which is sometimes found in iron, of being brittle in the cold, is attributed to the phosphoric acid contained in the ores; but as the same ore affords, by the same processes, better iron in one foundery than in another, the difference seems often to proceed in part from the charcoal.

Such are the principal causes of those spontaneous combustions, the effects of which are the more dangerous as they are less foreseen. The Society of Emulation has thought it would be doing an important service to every class of proprietors, and particularly to the inhabitants of the country, to put them in possession of such physical information as may enable them to guard against the dangers to which they too frequently fall victims in consequence of their ignorance and fatal imprudence.

On

On the Properties and Use of Vegetable Charcoal.

By M. SCHAUB.

Extracted from the ARCHIVES of PHARMACY and MEDICAL PHYSICS, by SCHAUB and PICPENBRING of CASSEL.

THE author relates some experiments made upon the oxyde of carbone, by M. Lowitz, and indicates the following precautions in certain processes. 1. The charcoal must be reduced to a coarse powder, and heated to redness in a mattrass, placed in a crucible surrounded with sand. 2. In some circumstances the charcoal must be employed in order to succeed.

1. The oxyde of carbone, according to the author, is employed with advantage for clarifying a great number of liquors.

2. It served him for whitening acetate of potash which had been turned brown by a too rapid evaporation, likewise for the tartarous acid and for various solutions of salts.

3. For purifying some fat oils.

4. Meat which had arrived at the highest degree of putrefaction, kneaded together with charcoal, entirely lost its putrid smell, and exhaled only an ammonical one. Mr. Schaub kept game covered with charcoal, for six weeks in hot seasons, without its undergoing the smallest change.

5. Honey dissolved in water, to which charcoal is added, loses its colour and smell. In this manner the juice of the beet has been purified.

6. A solution of prussiate of potash, containing much iron, and put to macerate with charcoal, becomes white, and affords very fine crystals: the muriatic acid added to

 the

the solution of this salt did not manifest the presence of iron till after a fortnight.

7. Brandy agitated with charcoal loses its smell, and the more certainly if it is distilled.

8. The residue of sulphuric ether mixed with charcoal, becomes clear and transparent like water.

9. Putrified urine in part loses its smell ; distilled upon charcoal, a considerable quantity of ammoniac was disengaged from it.

10. The smell of privies is diminished by throwing charcoal into them.

11. Charcoal added to a solution of sulphurat of potash produces a decomposition.

12. Different substances lost their smell, as valerian, galbanum, Peruvian balsam, musk, &c.

13. Charcoal discolours the tincture of turnsole, of cochineal, &c.

14. Finally, crude tartar, when boiled with charcoal, affords crystals of great whiteness and purity.

M. Hunold, military physician, has added some observations on the properties of charcoal with respect to the animal economy.

This physician first saw charcoal used at New York, in America. In that place there frequently prevails, especially among the lower orders of the people, a herpetic disease of the skin. Against this cutaneous malady which is a consequence of a very large quantity of alkali existing in the humors, produced by the too copious use of salt food, he has very frequently employed powdered charcoal, mixed with rum to the consistence of a soft paste, and this mass being applied to the diseased parts, the tetters soon dried off and disappeared.

Charcoal combined with Peruvian bark afforded him a very valuable remedy. He employed this powder with

success

success for rubbing scorbutic gums. The bleeding of the gums ceased, and the fetid smell of the breath was corrected.

He administered powdered charcoal, in the dose of half a drachm six times a day, with the best success, in putrid fevers. He also applied the powder to malignant ulcers of the legs with similar effect. He treated patients labouring under gangrenes with the best antiseptic remedies; but notwithstanding all his care the disease grew worse; when he tried the use of charcoal it assumed a more favourable aspect.

Composition for giving Oak and Pear Wood the Appearance of Mahogany, and Manner of covering those Woods with a durable Varnish. By M. DANNEMANN.

From CRELL'S CHEMICAL ANNALS.

FOR preparing this fine mordant, take for a surface of nine square feet a quarter of a pound of the best Fernambouc wood and an ounce of Roman alum. Let these ingredients boil for half an hour, in a gentle heat, with five-fourths of a quart of water, pass the liquid through a cloth, concentrate it to the quantity of a fourth of a quart, and add a scruple of purified potash. Tinge the wood with this preparation seven or eight different times, or till it has acquired a sufficiently intense and perfectly uniform colour. When the air is dry, the operation may be repeated three times a day. We must only take care not to let the rays of the sun fall upon the wood, lest it should warp. After the colour is sufficiently dried, we remove what has not penetrated with a piece of cloth,

 and

and cover the wood with a varnish composed of amber dissolved in oil of turpentine, and diluted with a little linseed-oil varnish. We may apply a layer every day, provided the preceding layer is sufficiently dry. We must always polish the layer which has been applied; for which purpose we rub it slightly, first with a piece of woollen cloth dipped in fine powder of amber mixed with a little water, and afterwards with a piece of fine linen dipped in olive oil triturated with whiting. The whole is then dried and polished till the wood has acquired a fine shining appearance.

Improved Method of preparing the Tartaric Acid.
By M. BUCHHOLZ.

FROM BEYTRÆGUE ZUR BERICHTIGUNG UND ERWEITERUNG DER CHIMIE.

REDUCE to fine powder six pounds of acidulous tartarated * potash, pour upon it a sufficient quantity of water,

* Cream of tartar, like every native substance, ought to derive its name from the chimico-mineralogical nomenclature, and not from the chemical nomenclature, which can only give denominations to artificial productions. I say *tartarated*, and not *tartarited*, because the acids with compound radicals cannot change their state of oxygenation without changing their nature or undergoing an alteration in the preportionale relations of their principles. They do not therefore form acids in *ic* and *ous*, but acids having in their quality the *maximum* of oxygene which they are capable of taking without ceasing to be acid of their name. The reasons for these changes, as well as for different others, which I have thought it necessary to introduce into chemical nomenclature, shall be explained in a particular work, which I intend to publish next summer.

water, and boil it in a tin basin. Then add by portions and during continual stirring, pure washed chalk, till no more effervescence takes place, and the liquor no longer reddens turnsol. The quantity of chalk requisite for this operation is generally about twenty-six ounces. After it has stood for some time, pour off the supernatant liquor and edulcorate the precipitate. A pound of tartarated potash yields in this manner nine ounces of tartarite of potash and four pounds three or four ounces of dry tartarate of lime. Upon this tartarate we pour, to a pound of the matter, six ounces seven drams and fifty grains of white sulphuric acid, weighing 1,840, which we previously dilute with six or eight times its weight of water, and we keep the mixture in warm digestion for three days, stirring it from time to time. After this we pass it through a linen bag, express it, wash the substance which remains, and evaporate it to dryness in a gentle heat. The mass, after having cooled, is anew dissolved in the least possible quantity of cold water, the solution filtrated, the remaining substance of sulphate of lime washed, the liquor evaporated to the consistence of a syrup, passed and pressed through a piece of linen, and put to crystallize by insensible evaporation in a place moderately heated. In this manner we obtain, from six pounds of acidulous tartarated potash, thirty-five or thirty-six ounces of tartaric acid in very fine crystals.

On

On the Preparation and Use of Soda.

By M. LEBLANC.

IT is in the crude state that soda generally presents itself in commerce; that is to say, with an admixture of foreign and useless parts, the quantity of which is generally estimated $\frac{75}{100}$; however the useful part of this substance, which is merely the alkali, may be separated from them, and still present itself in two different forms. In the first, we have crystallized soda, which retains in its crystals a large proportion of water, which is estimated at more than two-thirds of its weight: this water may be separated from it, and then we have the largest quantity of alkali in the smallest possible volume. Is it not in this state, which is now known by the name of *dried carbonate of soda*, that this substance ought to be presented? Would not this be a means of preventing the continual frauds, which that considerable difference, which exists in the richness or poorness of the crude sodas, has favoured perhaps ever since they have been in use. From the soda of Varec to the richest sodas of Alicant, there are infinite varieties: sodas have even been met with which contained for the greater part only sulphate of soda, and if these succeed in the manufacture of glass and bottles, it is because the sulphate is decomposed in the fusion. We shall not here enumerate all the advantages which would arise from converting into dried carbonate the soda at the very places where they are prepared; but there is at least every reason to believe, that the expenses of the purification would never amount to the rate of the price which is paid for the carriage of the useless matters which exist in these crude sodas. Be as it may with respect to these economical considerations, to which it does not appear

pear that much attention has hitherto been paid, I thought it might be of some utility to speak of the state of the case with regard to this alkali, which is of so much importance in the arts and commerce.

If, as can no longer be doubted, a pound of dried carbonate of soda is equivalent to three pounds of the same carbonate crystallized, and to six, eight, or ten pounds of crude soda, it is easy to determine the proportional quantities for all the cases in which this precaution may be required. Every person who cultivates the arts knows how necessary the purity of the substances is in many operations; some are of such a delicate nature that the slightest negligence would infallibly occasion their failure. For example, in the operations of dyeing it frequently happens that their success in producing the different casts of colour is frustrated, by the single circumstance that the substances employed had not quite the requisite degree of purity. The superiority of one manufacture over another, with respect to the lustre and solidity of the colours, is almost always owing to the different degrees of attention paid to circumstances of this kind. Soda, of which we treat more particularly in this place, has affinities with fatty matters, oxydes, certain earths, and a variety of different substances; it is therefore extremely susceptible of combination, and it may, in many cases, carry with it different substances of a nature contrary to the results which we wish to obtain with it. It is therefore a proof of ignorance to neglect such precautions, even in several cases of washing. We should not meet with spoilt leys, if the soda had always the property of carrying away whatever might stain or soil the linen, and if it did not often carry with it the matter of the very spots which it afterwards leaves; but there presents itself another question with respect to washing, which might

perhaps

perhaps merit a more careful investigation than has hitherto been bestowed upon it.

For a long time past, our wash-houses, in Paris and its environs, have employed only soda for whitening linen: hardly a few particles of potash of commerce were added, as it was still proscribed by a prejudice which perhaps was not without foundation; but the scarcity of soda, and the bad state of that which commerce then furnished, have given potash the predominancy: a great number of washers employ only this matter, which would whiten perfectly well, if it had not the inconvenience of injuring the texture of the linen. Several chemists, among whom I shall mention Darcet, the loss of whom we all lament, have considered it as demonstrated that the alkali of potash has a greater action than the alkali of soda upon the gluten of the filaments of hemp and flax. This difference of action is also remarked in several of the operations of art; and we know at present of how great importance it is to give the preference to soda, in several of those cases in which formerly either of these alkalies was employed indiscriminately. An able optician easily distinguishes glass which is manufactured with soda from that which is made with potash.

It is well known that Government, in order to free the country from a considerable annual expense, offered very liberal rewards for the purpose of obtaining a process whereby soda might be procured from the decomposition of sea-salt. The operations of M. Malherbe were the first which appeared to answer the purpose; and few persons occupied themselves with researches of this kind till I associated myself with the late M. d'Orleans. The process which gave rise to this association has been published by the revolutionary government; it was the fruit of my researches and of expenses which had for a long time absorbed